THE INFLUENCE OF MATERNAL OXYGEN (O_2) ADMINISTRATION ON FETAL HEART RATE (FHR) AND LONGTERM VARIABILITY AMPLITUDE (LVA)

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O_2 breathing in healthy adults causes a small decrease in heart rate (HR) (2). In healthy fullterm infants O_2 breathing also leads to a small decrease in HR (1). When the mother is breathing pure O_2, a decrease of FHR and LVA in the fetus can be observed (4). These observations have been confirmed previously (5). Using an algorithm for computer determination (CD) of FHR level and LVA (3), it was the aim of this paper to study the behaviour of FHR and LVA before and during maternal O_2 breathing with computer assistance.

MATERIAL AND METHODS

In 14 cases the mothers were breathing O_2 via a face mask for about 10 min., having been instructed not to hyperventilate and were kept in the lateral position. Recordings were made of FHR and uterine activity as well as fetal $tcPo_2$. FHR and LVA were estimated visually and by using an algorithm, which makes a histogram of all FHR values. From this distribution the 10th and 90th percentile is estimated and it's distance multiplicated with a constant factor of 1.2. The result represents the actual LVA (3). When comparing the CD FHR and LVA with the visually estimated one, a very good agreement was found ($2\alpha < 0.001$).

RESULTS

In 11 of the 14 cases the $tcPo_2$ increased and FHR and LVA decreased when the mother was breathing pure O_2. When plotting LVA against fetal $tcPo_2$ before and during the period of O_2 breathing it became obvious that LVA decreased with an increase in fetal $tcPo_2$ (Fig. 1). There was a significant increase in fetal $tcPo_2$ by $\bar{x}$ = 5 mmHg ($2\alpha < 0.001$), a significant decrease in FHR by $\bar{x}$ = 4 bpm (2α 0.05) and a significant decrease in LVA by $\bar{x}$ = 6,7 bpm ($2\alpha < 0.001$).
In the other three cases the FHR remained constant whilst the LVA slightly increased during fetal $tcPo_2$ increase. The fetal $tcPo_2$ level prior to maternal O_2 breathing was not significantly different in both groups. There was however a significant difference between the initial basal FHR level in the two groups before the onset of maternal O_2 breathing. The mean basal FHR in the group of FHR and LVA decrease was 138 bpm compared with 126 bpm in those cases showing only an increase in LVA ($2\alpha < 0.01$). To draw any conclusions from the difference, the number of cases in the second group is too small. It might be possible that the change in activity-status was masked in some way.

DISCUSSION

O_2 breathing in normal subjects causes a small decrease in HR, which is abolished by atropine and therefore probably vagal in origin, and results in a comparable rate-dependent decrease in cardiac out-

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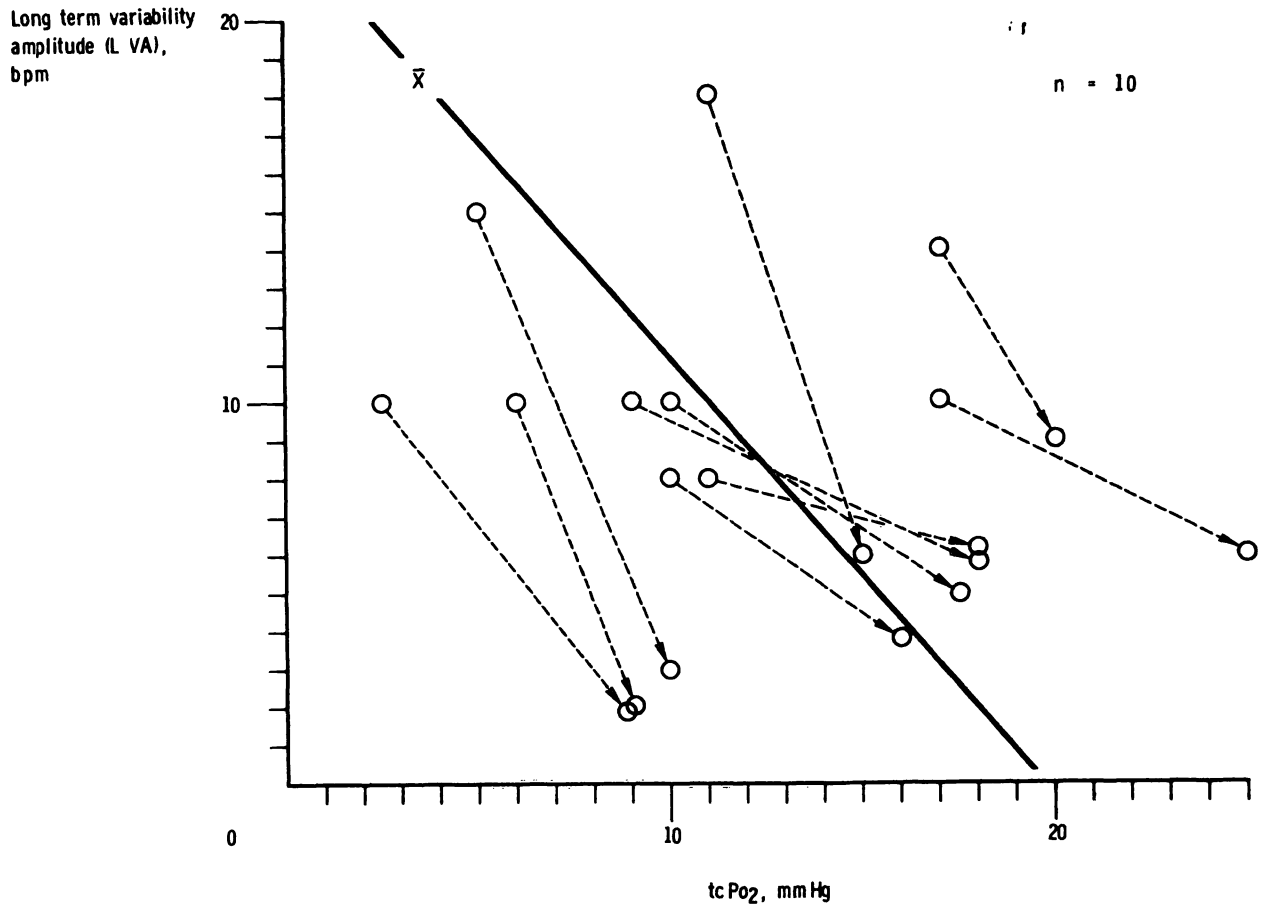

Fig. 1 shows the LVA plotted against the fetal $tcPo_2$ before and during maternal O_2 breathing. An increase in fetal $tcPo_2$ is followed by a LVA-decrease.

put (2). In healty fullterm newborns O_2 breathing results in a small decrease in HR which persists while the baby is breathing O_2 (1). Since ventilation decreases at the same time, this may not be a pure chemoreceptor response. In the fetus our observation of a decrease in FHR and LVA with an increase of $tcPo_2$ can be taken as evidence of chemoreceptor activity.

CONCLUSIONS

1.) Maternal O_2 breathing leads to a fetal $tcPo_2$ increase.
2.) During maternal O_2 breathing FHR and LVA decreases in 11 of 14 cases.
3.) This effect of O_2 on FHR and LVA is suggestive of chemoreceptor activity in the fetus.
4.) The algorithm for CD of FHR-LVA (3) allows this parameter to be readily and quantitatively assessed and shows a very good agreement with the visual analysis.

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